What is claimed is:

1. A method of forming a silicon nitride layer, comprising:

providing a substrate having a silicon surface thereon;

performing an ion implant process on the silicon surface, implanting nitrogen atoms into the silicon surface; and

performing a thermal nitridation process, forming a silicon nitride layer on the substrate, wherein the silicon nitride layer comprises the silicon nitride formed on the silicon surface by reaction of the silicon surface with the nitrogen atoms therein.

2. The method as claimed in claim 1, wherein the silicon nitride layer further comprises the silicon nitride formed by reaction of the silicon surface with a nitrogen-containing gas in the thermal nitridation process.

3. The method as claimed in claim 1, wherein the substrate is silicon substrate.

4. The method as claimed in claim 1, wherein the silicon surface is a plane silicon surface of a silicon surface within an opening.

5. The method as claimed in claim 1, wherein the source gas for the ion implant process is nitrogen gas (N_2).

6. The method as claimed in claim 1, wherein the implant energy for the ion implant process is between 200eV and 200KeV.

7. The method as claimed in claim 1, wherein the implant dosage for the ion implant process is between $1*10^{14}$ atoms/cm^2 and $5*10^{17}$ atoms/cm^2.

8. The method as claimed in claim 1, wherein the thermal nitridation process is a furnace nitridation process or a rapid thermal nitridation (RTN) process.

9. The method as claimed in claim 1, wherein the process temperature for the thermal nitridation process is between 500°C and 1200°C.

10. The method as claimed in claim 1, wherein the process gas for the thermal nitridation process is NH_3, N_2, N_2O or NO.

11. A method of forming a silicon nitride layer for a bottle-shaped trench process, comprising:

providing a silicon substrate;

forming a trench in the silicon substrate;

conformally depositing a dielectric layer in the trench;

selectively etching the dielectric layer, exposing an upper region in the trench and sidewalls thereof, leaving a lower region in the trench covered by the remaining dielectric layer;

performing an ion implant process, implanting nitrogen atoms into the silicon substrate adjacent to the sidewalls;

performing a thermal nitridation process, forming a silicon nitride layer on the surface of the sidewalls, wherein the silicon nitride layer includes the silicon nitride formed on the silicon surface by reaction of the silicon surface with the nitrogen atoms therein;

removing the remaining dielectric layer from the lower region of the trench; and

using the silicon nitride layer as an etching mask, etching the silicon substrate in the lower region, forming an expanded region therein, and forming a bottle-shaped trench consisting of the trench portion in the upper region and the expanded region in the lower portion.

12. The method as claimed in claim 11, wherein the silicon nitride layer further comprises the silicon nitride formed by reaction of the silicon surface with a nitrogen-containing gas in the thermal nitridation process.

13. The method as claimed in claim 11, wherein the dielectric layer is silicon dioxide.

14. The method as claimed in claim 11, wherein the method for depositing the dielectric layer is LPCVD or liquid phase deposition (LPD).

15. The method as claimed in claim 11, wherein the method as claimed in claim 1, wherein the source gas for the ion implant process is nitrogen (N_2).

16. The method as claimed in claim 11, wherein the implant energy for the ion implant process is between 200 eV and 200 KeV.

17. The method as claimed in claim 11, wherein the implant dosage for the ion implant process is between $1*10^{14}$ atoms/cm^2 and $5*10^{17}$ atoms/cm^2.

18. The method as claimed in claim 11, wherein the thermal nitridation process is a furnace nitridation process or a rapid thermal nitridation (RTN) process.

19. The method as claimed in claim 11, wherein the process temperature of the thermal nitridation process is between 500°C and 1200°C.

20. The method as claimed in claim 11, wherein the etching method for forming the expanded region is wet etching.

21. The method as claimed in claim 11, wherein the expanded region is wider than the trench in the upper region.

22. The method as claimed in claim 11, wherein the process gas for the thermal nitridation process is NH_3, N_2, N_2O or NO.